FUNDAÇÃO GETULIO VARGAS

EPGE

Escola de Pós-Graduação em Economia

Ensaios Econômicos

Escola de Pós-Graduação em Economia da Fundação Getulio Vargas

N° 435 ISSN 0104-8910

Elections and Exchange Rate Policy Cycles

Marco Antônio Cesar Bonomo, Maria Cristina T. Terra

Outubro de 2001

URL: http://hdl.handle.net/10438/447

Antônio Cesar Bonomo, Marco
Elections and Exchange Rate Policy Cycles/
Marco Antônio Cesar Bonomo, Maria Cristina T. Terra - Rio de Janeiro : FGV,EPGE, 2010
(Ensaios Econômicos; 435)

Inclui bibliografia.

CDD-330

Elections and Exchange Rate Policy Cycles*

Marco Bonomo and Cristina Terra
Graduate School of Economics
Getulio Vargas Foundation

October 2001

1 Introduction

Recent empirical studies on Latin American countries' exchange rate policy (Frieden, Ghezzi and Stein 2001, Bonomo and Terra 1999[1]) have identified a new type of electoral cycle: the real exchange rate (RER) tends to be more appreciated than average in the months preceding elections and more depreciated than average in the months following elections.

This paper presents a theoretical model that generates real exchange rate cycles. In doing so, we have singled out the distributive effects of real exchange rate changes as the main ingredient leading to exchange rate policy cycles. Typically, a RER depreciation favors exporters and import competing domestic industries, to the detriment of consumers. We argue that these exchange rate cycles can be explained by imperfect information on policymakers' preferences, which are concealed with the help of an unstable macroeconomic environment. If preferences were known to the public, the candidate more identified with the interests of the nontradable sector would always be elected, on the assumption that this sector holds the majority of votes.

More specifically, we posit that there are two possible types of policymakers whose preferences are a convex combination of the two sectors' preferences. We

*We thank Octavio Amorim Neto, Avinash Dixit, Ilan Goldfajn, Maria Gonzalez, Hugo Hopenhayn, Fabio Kanczuk, Marcos Lisboa, Andy Neumeyer, Jorge Streb, Carlos Winograd, seminar participants at the Political Economy Group Seminar of LACEA, XVII LAMES, EEA Meeting, ANPEC, Universidad Torquato Di Tella, University of Illinois, IPEA, Getulio Vargas Foundation, UFRJ, UnB and CIRANO for comments and discussion, and Ivana Dall 'Agnol for research assistance. We also acknowledge research fellowships from CNPq and financial support from PRONEX.

[1]Bonomo and Terra (1999) use a Markov Switching Model to characterize statistically the exchange rate regimes in Brazil, defined as overvalued or undervalued real exchange rates, and the influence of political economy variables on regime changes. They found an election cycle: the probability of having an overvalued exchange rate is higher in the months preceding elections, while the probability of having a undervalued exchange rate is higher in the months succeeding elections.

refer to the type which places a higher weight on nontradable sector preferences as the nontradable type, the other being the tradable type. The policymaker may affect the relative gains for the two sectors by choosing the level of expenditures on nontradable goods, thereby altering the equilibrium RER. Voters try to extract information about the policymaker preferences by observing the real exchange rate. They elect the incumbent if the probability that her type is nontradable is higher than that of the opponent.

We also assume that there are exogenous shocks to the external sector, which make economic policy to be observed with noise. Thus, a given real exchange rate is compatible with different combinations of policies and shocks. Therefore, it is not necessary that the tradable type of policymaker perfectly emulates the other type to stand a chance of being reelected. The policymaker will choose the exchange rate policy by weighting his immediate interests (the depreciated exchange rate raises the tradable sector's gain) against his long-run interests, which depend on his reelection (whose probability increases with a more appreciated RER). The incumbent of a tradable type may choose higher expenditures than his optimal full information level. He might do so to increase the probability that voters will believe that he is more likely to be a nontradable type than the opponent. The nontradable type choose higher expenditures than his optimal full information level to increase the probability of differentiating himself from the tradable type. Hence, there will be a cycle in expenditures in case of reelection of the incumbent regardless of her type. This will, thus, lead to an exchange rate electoral cycle.

There is a large and growing literature on political economic cycles. Theoretical models in this literature fall basically into two categories: partisan and opportunistic models. In partisan models the cycles are generated by the interaction between nominal rigidities and the different parties' preferences regarding inflation and unemployment (Hibbs 1977, and Alesina 1987). Each type of prospective policymaker has an exogenous probability of winning the election, and expectations about economic policy choice after elections are calculated accordingly. Opportunistic models rely only on policymakers' electoral motivations (Nordhaus 1975, Lindbeck 1976, Cukierman and Meltzer 1986, Rogoff and Silbert 1988, Persson and Tabelini 1990, Rogoff 1990, and Stein and Streb 1998a). In particular, Rogoff and Silbert (1988) and Rogoff (1990) build a political budget cycle theory based on information asymmetry about government efficiency. Recently, Drazen (2001) proposed a model with a similar mechanism, that is, with fiscal policy as the driving force behind political cycles, but also including passive monetary policy.

Ghezzi, Stein and Streb (2000) builds on the same information asymmetry about the incumbent's competence to generate a real exchange rate cycle, which works in the same way as a tax cycle (Rogoff and Silbert 1988, Stein and Streb 1998a). In this story maintaining an appreciated exchange rate is desirable for the society but maybe not sustainable.

Our modeling stands between those two approaches. Policymakers differ in their preferences over economic policy, as in partisan models, but preferences are not constant. Thus, voters do not learn them in the long run. The policymaker's action affects his probability of reelection, as in opportunistic models. However, in our model policymakers' actions cannot be revealed by the economic performance, which is also influenced by events beyond their control. Hence, exogenous economic shocks affect election results systematically. This is another qualitative feature consistent with the empirical evidence (see Alesina and Rosenthal 1995, for the US, and Lewis-Beck 1988, for the OECD countries). Furthermore, since in our model the government intervenes in the exchange rate market by taxing tradable goods' producers and spending on nontradable goods, we also generate a political budget cycle, which is in line with existing empirical evidence in developing countries (see Gonzalez 2000 with evidence for Mexico, Ames 1987 for Latin American countries, Block 2000 for 44 sub-Saharian African countries, and Schuknecht 1996 for a comprehensive study). Finally, conflict of interests within the private sector plays a central role in our story. Although this feature has been extensively studied in other areas of political economy, such as trade policy, it has not been explicitly taken into account in the political business cycle literature[2].

The plan for the remaining part of the paper is as follows. Section 2 develops the model of policy intervention in the exchange rate around electoral periods. Section 3 solves for the equilibrium of the model. Section 4 works through an example by assigning specific functional forms to the model. Finally, conclusions are presented in section 5.

2 The Model

2.1 nontradable sector, tradable sector, and government

There are two non-storable goods in this model economy: a tradable and a nontradable good. Citizens are divided into two sectors: tradable and nontradable sectors. Citizens belonging to the (non)tradable sector are endowed each period with some amount of the (non)tradable good. Every citizen derives utility from the consumption of both tradable and nontradable goods, subject to her budget constraint. There are no financial markets, hence each period's expenditures in consumption must equal the endowment's value, minus taxes. All preferences, both of government and common citizens, are additively separable in time with discount factor β. This assumption will simplify some intertemporal relations making the consumers' problem time separable.

The indirect utility function of a citizen in the nontradable sector (i.e. a citizen endowed with the nontradable good) for each period can be represented by:

$$V^N(e_t) = \widetilde{v}^N\left(e_t, E_t^N\right), \tag{1}$$

where e_t is the RER, defined as the ratio between the price of tradable and nontradable goods, and E_t^N is the endowment of nontradable goods each citizen

[2] Alfaro (1999) also develops a model focusing on distributive effects of real exchange rate appreciation. However, her model aims to explain the political economy of exchange-rate-based stabilization programs, instead of electoral cycles.

in the sector receives. The nontradable sector citizen does not pay taxes. This indirect utility function is decreasing in e_t, and increasing in E_t^N. We assume that consumers maximize a continuous concave utility function, hence indirect utility functions are also continuous. Additionally, the nontradable endowment is constant over time, $E_t^N = E^N$.

Uncertainty is introduced in the tradable sector. The endowment of tradable good E_t^T each citizen in the sector receives is assumed to be a stochastic variable represented by u_t, where u_t is a random variable. Moreover, each citizen belonging to the tradable sector pays taxes, τ_t. Hence, the per period indirect utility function for the tradable sector citizen can be represented by:

$$V^T\left(e_t, u_t, \tau_t\right) = \widetilde{v}^T\left(e_t, E_t^T, \tau_t\right). \tag{2}$$

This indirect utility function is increasing in the RER, increasing in the good endowment, and decreasing in τ.

In each period the government chooses how much to spend on nontradable sector goods, and it finances its expenditures by taxing tradable sector citizens: $G_t = \tau_t$, where G_t are expenditures per tradable sector citizen, respectively. There is an upper bound to raising taxes, since they cannot exceed the tradable good endowment value. Therefore, we posit that government expenditures must lay in the interval $\left[0, \overline{G}\right]$, where $\overline{G}$ is such that tradable sector citizens have a positive after tax income. Government expenditures are all wasted. We assume that the total amount of taxes is not immediately observable by the nontradable sector citizens.

2.2 Market equilibrium conditions

As financial markets are assumed away, not only the nontradable, but also the tradable goods market must be in equilibrium.[3] Given the amount of expenditures chosen by the government, and tradable goods endowments, RER must be such that both goods market are in equilibrium, that is:

$$G_t + N_T\left(e_t, u_t, \tau_t\right) + nN_N\left(e_t\right) = nE^N \tag{3}$$

$$T_T\left(e_t, u_t, \tau_t\right) + nT_N\left(e_t\right) = u_t \tag{4}$$

where $N_J(.)$ and $T_J(.)$ represent the J-sector citizen demand functions for the nontradable and tradable goods, respectively, and n is the ratio between the number of nontradable and tradable sector citizens. By solving either of the equations, we obtain the equilibrium RER as a function of the exogenous variables, $e\left(G_t, u_t\right)$, given that $G_t = \tau_t$, and all other variables are constant. Given concavity and continuity of utility function, the demand functions are

[3] Since there are no financial markets and there is only one tradable good, the market equilibrium conditions for this economy match those of a closed economy. Note that the driving force is our story is the effect of the real exchange rate, that is, relative prices, on different economic agents' utility. Hence, it is not related to intertemporal effects. The inclusion of financial markets would allow for trade deficits or surpluses with the accompanying debt or loan. This would complicate the model without changing the results.

continuous. Therefore, $e(\cdot)$ is a continuous function. It is easy to check that the equilibrium RER is a negative function of expenditures level, that is, the more the government spends on nontradable goods, the more appreciated is the equilibrium RER. The equilibrium RER is also a negative function of tradable goods endowments: the larger the tradable goods endowment, the lower its relative price, hence the more appreciated is the equilibrium RER.

2.3 Policymakers' preferences

Policymakers' preferences are represented by a utility function which is a weighted sum of the two sectors' utility functions:

$$\widetilde{v}_i^P(e_t, u_t, \tau_t) = \gamma_i V^N(e_t) + V^T(e_t, u_t, \tau_t), \text{ for } i = N, T. \tag{5}$$

We assume that there are two possible types of policymaker. This is captured by different relative weights on the nontradable sector utility function, represented by γ_i, $i = N, T$, in the politician's utility function represented by equation 5. Specifically, $\gamma_N > \gamma_T$, where γ_N is the relative weight for the politician that favors nontradable sector' interests relatively more.

Substituting the equilibrium RER derived from market equilibrium conditions in equation 5, and using the fact that expenditures equal taxes, the policymaker's utility function can be rewritten as:

$$V_i^P(G_t, u_t) = \gamma_i V^N(e(G_t, u_t)) + V^T(e(G_t, u_t), u_t, G_t), \text{ for } i = N, T. \tag{6}$$

Nontradable sector citizens always prefer higher expenditures, because the latter produce a more appreciated real exchange rate. Tradable sector citizens prefer lower expenditures, because it results in a more depreciated exchange rate and less taxes to be paid. Therefore, the policymaker's indirect utility function may be non-monotonic in expenditures G_t.

2.4 Elections and timing of events

We assume that each sector is composed of identical individuals, so they will have the same voting preferences. We also assume that nontradable sector citizens are more numerous ($n > 1$), hence the median voter is a nontradable sector citizen.

Elections are held every other period, and there are two candidates: the incumbent and the opponent. The political processes establishing which interests each politician favors are resolved in the alternate periods. Such processes can be either campaign finance, lobbying or sheer bribery. It would take us far afield were we to properly model the processes by which politicians are captured by economic interests. So we simply represent these processes by assuming that both incumbent and opponent are independently assigned to favor the nontradable sector with probability p^N. The government, knowing its own type, chooses an expenditure level. Then, the tradable good endowment is realized, resulting in a certain equilibrium RER. The median voter observes the exchange rate, but not the expenditure level, and then votes[4].

We summarize the timing of events is as follows:

Pre-election period (t^*):

The incumbent and the opponent are randomly assigned the interest group they favor, and the incumbent sets G_{t^*}. u_{t^*} is realized after the choice of G_{t^*} determining $e_{t^*} = e(G_{t^*}, u_{t^*})$.

Without observing G_{t^*}, or the incumbent and the opponent types, the median voter (a nontradable sector voter) observes e_{t^*} and then votes.

After-election period ($t^* + 1$):

The winner of elections takes office for two periods, and chooses G_{t^*+1}.

3 Equilibrium conditions

In this section we analyze a game between the policymaker, the opponent, and the median voter. We compute the Perfect Bayesian Equilibrium for the dynamic Bayesian game. The equilibrium is composed of the incumbent's and the median voter's strategies and beliefs. Our assumptions allow us to break our problem into a sequence of identical two-period stage games[5]. Hence, they also allow us to restrict our analysis to equilibria in which strategies prescribe the same actions in every stage game, that is, actions which are independent from results in previous stage games.

In the stage game the incumbent's strategy is the expenditure level chosen for each type of policymaker for the periods before and after elections. It can be represented by $G^* = \{G^N, G^N_{+1}, G^T, G^T_{+1}\}$, where G^i and G^i_{+1} is the expenditure level for the period before and after elections, respectively, for type i policymaker, which can be either of nontradable ($i = N$) or tradable ($i = T$) types. The median voter's strategy is the choice of a candidate in the election period, given the observed real exchange rate. It can be represented by the function $vo(\hat{e})$, which equal *inc* when the voter votes for the incumbent, or *opp* when the vote casts a ballot for the opponent, given the observed real exchange rate $\hat{e}$.

We start by finding the equilibrium of a complete information version of the game, which will serve as a benchmark.

[4] This assumption is not unnatural as it may appear. The median voter is a non-tradable sector citizen, who must observe the relative price to trade, but does not bear a direct impact from expenditure or tax level.

[5] The assumptions of no financial markets, non-storable goods, time separable utility, and that politicians preferences are independently drawn every two periods, imply that the action's effects on future payoffs do not depend on actions taken before the pre-electoral period (see also footnote 7).

3.1 Equilibrium under full information

In the complete information version of the game voters know the incumbent's and the opponent's type. The optimal strategy for the median voter is for him to vote for the incumbent when the latter is of the nontradable type, and to vote for the opponent otherwise, for any observed exchange rate. Therefore, economic policy will not affect the reelection probability. Since expenditures policy has no intertemporal effects, it will be chosen each period so as to maximize the policymaker's per period expected utility; that is, G^i should maximize:

$$F_i(G_t) \equiv E\left[V_i^P\left(G_t, u_t\right)\right] = \int_0^\infty V_i^P\left(G_t, u_t\right) f(u) du, \tag{7}$$

where utility $V_i^P\left(G_t, u_t\right)$ is given by equation 6.

Let G^{i*} be the level of expenditures which maximizes $F_i(.)$. For later reference we define $F_i^j = F_i(G^{j*})$. Then, it is clear that $F_i^i \geq F_i^j$ for every i, j. A proposition in Appendix A formalizes the equilibrium.

3.2 Equilibrium under asymmetric information

In the period following an election, there is no strategic behavior. The reason is that there will be political negotiations next period determining the policymaker's new preferences. We assume that the outcome of political negotiations are independent from the incumbent's performance[6]. Thus, $\left\{G_{+1}^N, G_{+1}^T\right\} = \left\{G^{N*}, G^{T*}\right\}$, where G^{i*} is the expenditure level that maximizes $F_i(.)$. Notice that these expenditure levels correspond to the equilibrium strategies for the incumbent under full information. From now on we focus on the policymaker's strategy in the period preceding election.

We start by solving the voter's problem and calculating the incumbent's reelection probability, which will be a function of the chosen expenditure level.

3.2.1 The Voter's Problem

The median voter, being of the nontradable type, would like to vote for the policymaker who favors his interests, but now he does not know the politician's type. He compares the (updated) probability of the incumbent being of the nontradable type to that of the opponent (which will always be p^N, as the voter does not have any extra information about the opponent). If the updated probability is larger than or equal to p^N, nontradable voters will vote for the incumbent, and she will be reelected. Otherwise the opponent will win the elections. Let ρ be the median voter's conjecture that the incumbent is of the nontradable type, and vo his vote. Then:

$$vo = \begin{cases} inc, & if\ \rho \geq p^N \\ opp, & otherwise \end{cases} .$$

[6] Hence, the expenditure level chosen in a period following election will not affect the probability of reelection in the next stage game.

This voter's behavior is optimal, for it maximizes her expected utility, given that she is of the nontradable sector.

How do voters form their belief ρ? The only information they have is the RER, which is a function of the economic policy chosen by the incumbent, and the supply shock in the tradable sector. When the RER is compatible with the incumbent's equilibrium strategy, voters update their prior beliefs about the incumbent's type using Bayes's rule. Then, the updated probability may be represented by[7]:

$$\begin{aligned}\rho &= \Pr\left(t_i = N \,|e_t = \hat{e}\,\right) = \\ &= \frac{p^N \times g(e_t = \widehat{e}\,|t_i = N\,)}{p^N \times g(e_t = \widehat{e}\,|t_i = N\,) + (1-p^N) \times g(e_t = \widehat{e}\,|t_i = T\,)},\end{aligned} \tag{8}$$

where t_i represents the incumbent's type, which may be nontradable (N) or tradable (T), $\hat{e}$ is the observed real exchange rate, and $g(.\,|.)$ is the conditional density function of e given the policymaker's type. Then it is clear that the voter will vote for the incumbent, that is $\rho \geq p^N$, if and only if:

$$g(e_t = \widehat{e}\,|t_i = N\,) \geq g(e_t = \widehat{e}\,|t_i = T\,). \tag{9}$$

This rule is intuitive. The voter revise upwards his prior that the government is of the nontradable type if and only if it is more likely that the observed exchange rate was generated by the nontradable type policy than by the tradable type.

If the observed exchange rate is not compatible with the incumbent strategy in equilibrium, then a perfect Bayesian equilibrium does not impose any constraints on beliefs ρ. For each expenditure level, there is a set of feasible exchange rate levels, which result from all possible realizations of the trade shock u. We define exchange rate equilibrium set as the union of the feasible exchange rate sets, corresponding to each equilibrium expenditure level. For the exchange rates that are not in the exchange rate equilibrium set, we restrict beliefs, in the spirit of the intuitive criterion, using the following assumption: if the exchange rate is more depreciated than any one which could be generated by a nontradable type incumbent, voters set $\rho = 0$; otherwise they set $\rho = 1$. We summarize this as follows:

Assumption A: Let G^i represent the equilibrium expenditure level for type i incumbent. If $\widehat{e} \notin \{e : e = e(G^i, u) \text{ and } f(u) > 0,\ i = N, T\}$ and $\widehat{e} > \sup_{\{w:f(w)>0\}}\{e\left(G^N, w\right)\}$, then $\rho = 0$. If $\widehat{e} \notin \{e : e = e(G^i, u) \text{ and } f(u) > 0,$ $i = N, T\}$ and $\widehat{e} \leq \inf_{\{w:f(w)>0\}}\{e\left(G^N, w\right)\}$, then $\rho = 1$.

Given assumption A, if the observed exchange rate is out of the equilibrium set, the condition for reelection is:

$$\widehat{e} \leq \inf_{\{w:f(w)>0\}}\{e\left(G^N, w\right)\}. \tag{10}$$

[7] The assumption that politicians preferences are independently drawn every two periods make the voter's updated beliefs independent of actions taken by the incumbent before the latest draw.

Summing up, the incumbent will be reelected if the exchange rate is in the equilibrium set and condition 9 holds, or if the exchange rate is below (that is, more appreciated than) the lowest exchange rate which could be generated by a nontradable type of incumbent in equilibrium.

3.2.2 Reelection probability

Now we can calculate the incumbent's reelection probability as a function of the chosen expenditure level. To do so, it is necessary to specify the incumbent's actions prescribed by equilibrium strategy in the period before election $\left\{G^N, G^T\right\}$, which will be used by the voter to update his beliefs.

A chosen expenditure level G and a realized trade shock u will determine the observed real exchange rate, i.e., $\widehat{e} = e\left(G, u\right)$. Therefore, the conditional density function of $\widehat{e}$ given the policymaker's type $g(.\,|.)$ is equal to the density function of the trade shock v that would yield $\widehat{e}$ when the expenditure level is the one chosen by this type in equilibrium. That is, $g(e_t = \widehat{e}\,|t_i) = f\left(v\left|e\left(G^i, v\right) = \widehat{e}\right.\right)$.

Then, we can write conditions for reelection 9 and 10 in the following way:

$$f\left(w\left|e\left(G^N, w\right) = \widehat{e}\right.\right) \geq f\left(v\left|e\left(G^T, v\right) = \widehat{e}\right.\right)$$
$$\text{and } f\left(w\left|e\left(G^N, w\right) = \widehat{e}\right.\right) > 0, \tag{11}$$
$$\widehat{e} \leq \inf_{\{w: f(w) > 0\}} \{e\left(G^N, w\right)\}. \tag{12}$$

As the observed exchange level results from the chosen expenditure level and the realized shock u, $\widehat{e} = e(G, u)$, we can write the probability of reelection, $\pi(G, G^T, G^N)$ as:

$$\pi(G, G^T, G^N) = \tag{13}$$
$$\Pr\left(\left\{\begin{array}{c} u : f\left(w\left|e\left(G^N, w\right) = e(G, u)\right.\right) \geq f\left(v\left|e\left(G^T, v\right) = e(G, u)\right.\right) \\ \text{and } f\left(w\left|e\left(G^N, w\right) = e\left(G, u\right)\right.\right) > 0, \\ \text{or } e(G, u) \leq \inf_{\{w: f(w) > 0\}}\{e\left(G^N, w\right)\} \end{array}\right\}\right).$$

The reelection probability as a function of expenditures G depends on G^T, G^N, and the trade shock distribution. Observe that if a pooling equilibrium exists, it prescribes that the median voter chooses to reelect the incumbent. Formally, condition 11 is always satisfied with equality. Equation 13 implies that the probability of reelection is one.

In the case of a separating equilibrium, it is desirable for the exchange rate to have a cutoff level $\tilde{e}$, such that whenever the observed exchange rate is more appreciated than $\tilde{e}$ ($\hat{e} \leq \tilde{e}$) the median voter reelects the incumbent. The following assumption about the trade shock distribution function ensures this will happen.

Definition 1 The density function $f\left(.\right)$ is single peaked if there is a nonempty set X of elements x which satisfy:

- if $x \geq z > y$, then $f(z) \geq f(y)$

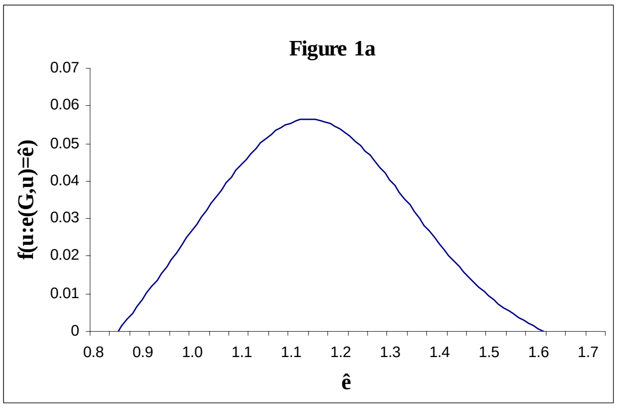
- if $x \leq z < y$, then $f(z) \geq f(y)$.

Definition 2 The density function has a single peak plateau if it is single peaked and

- $\forall x, x'$ such that $f(x) = f(x') > 0$ then $x, x' \in X$

Assumption B: The density function $f(.)$ has a single peak plateau.

Figures 1 and 2 present an example of how the reelection probability is obtained in a separating equilibrium, and how it is affected by the expenditures level.



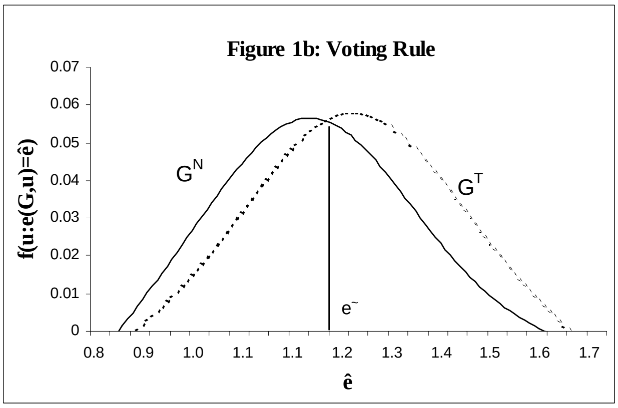


Figure 1 depicts the median voter's decision. In Figure 1a the horizontal axis shows the observed exchange rate level and the vertical axis represents the probability density function of the trade shock which would generate that observed exchange rate level for a given expenditure level $f\left(u\left|e\left(G,u\right)=\widehat{e}\right.\right)$. Figure 1b replicates the curve of figure 1a for the equilibrium expenditure levels: G^N and G^T, with $G^N > G^T$. The vertical line shows the cutoff level of exchange rate, $\widetilde{e}$. For an exchange rate $\widehat{e}$ lower than $\widetilde{e}$, the density of the trade shock which, combined with the expenditure level G^N, would generate $\widehat{e}$ $\left(f\left(w\left|e\left(G^N,w\right)=\widehat{e}\right.\right)\right)$ is higher than the equivalent density for the expenditure level G^T $\left(f\left(v\left|e\left(G^T,v\right)=\widehat{e}\right.\right)\right)$, as in equation 11. In this case the incumbent will be reelected. Conversely, if the exchange rate level is higher than $\widetilde{e}$, the compatible trade shock density is higher for the expenditure level G^T, violating equation 11, and the incumbent is not reelected.

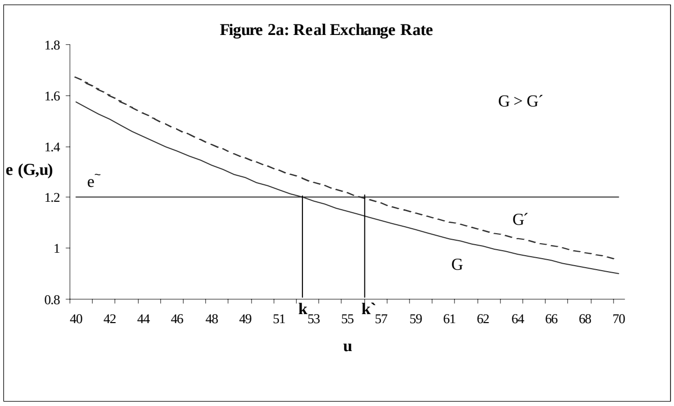


Figure 2a: Real Exchange Rate

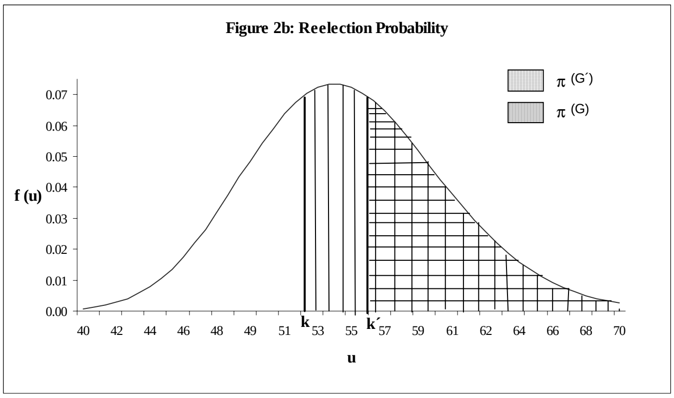


Figure 2b: Reelection Probability

Figure 2 shows how the reelection probability is determined by the expenditures level, using as input the cutoff level $\widetilde{e}$ found in Figure 1. Figure 2a maps the exchange rate cutoff level $\widetilde{e}$ (in the vertical axis) into a trade shock cutoff level k (in the horizontal axis), for a given expenditure level G. Whenever the trade shock is larger than k, the resulting exchange rate will be more appreciated than $\widetilde{e}$, and the incumbent will be reelected. We depict two curves, the upper curve corresponding to a lower expenditure level G', which yields a higher trade shock cutoff level k'. Figure 2b uses the probability density function for the trade shocks to determine the reelection probability, which is the area under the density function to the right of k. It is clear from the figure that a lower expenditure level G' leads to a higher trade shock cutoff level k', resulting in a lower reelection probability.

The following proposition formalize how the reelection probability is computed, as exemplified above.

Proposition 3 Suppose that beliefs satisfy Assumption A, and the probability distribution of trade shocks is continuous and has a density function $f(\cdot)$ which satisfies Assumption B. Assume that $G^N > G^T$. Then, the incumbent's reelection probability, given the equilibrium strategy, can be written as:[8]

$$\pi\left(G, G^N, G^T\right) = \int_{k(G,G^N,G^T)}^{\infty} f(s)\, ds, \tag{14}$$

where $k\left(G, G^N, G^T\right)$ is defined implicitly by $\widetilde{e}\left(G^N, G^T\right) = e(G, k)$, and $\widetilde{e}\left(G^N, G^T\right)$ is defined by:

$$\widetilde{e}\left(G^N, G^T\right) = \sup\left\{ \begin{array}{c} \hat{e} : f\left(w \left| e\left(G^N, w\right) = \hat{e}\right.\right) \geq f\left(v \left| e\left(G^T, v\right) = \hat{e}\right.\right), \\ f\left(w \left| e\left(G^N, w\right)\right.\right) > 0 \end{array} \right\}.$$

Proof. See Appendix B. ■

Note the definition of $\widetilde{e}\left(G^N, G^T\right)$ is general enough to comprise cases in which the probability density functions for G^N and G^T have any number of intersections.

3.2.3 Incumbent's Strategy

The expenditures level chosen by the incumbent not only affects his contemporaneous utility, but also the reelection probability. Reelection probability is an

[8] This proposition can be easily extended for the case in which the type i incumbent uses a mixed strategy defined by the cumulative distribution H^i on $\left[0, \overline{G}\right]$. The incumbent's reelection probability becomes:

$$\pi\left(G, H^N, H^T\right) = \int_{k(G,H^N,H^T)}^{\infty} f(s)\, ds$$

where $k\left(G, H^N, H^T\right)$ is defined implicitly by $\widetilde{e}\left(H^N, H^T\right) = e(G, k)$. $\widetilde{e}\left(H^N, H^T\right)$ is defined by:

$$\widetilde{e}\left(H^N, H^T\right) =$$
$$\sup\left\{ \begin{array}{c} e' : \int_0^{\overline{G}} f\left(w \left| e\left(G^N, w\right) = e'\right.\right) dH^N\left(G^N\right) \geq \int_0^{\overline{G}} f\left(v \left| e\left(G^T, w\right) = e'\right.\right) dH^T\left(G^T\right), \\ f\left(w \left| e\left(G^N, w\right) = e'\right.\right) > 0 \end{array} \right\}.$$

important component of next period expected gains - the elected government first term in office. In equilibrium, expenditures will be chosen to solve:

$$\max_{G}\left\{\begin{array}{c} F_i(G)+ \\ +\beta\left[\pi\left(G,G^T,G^N\right)+\left(1-\pi\left(G,G^T,G^N\right)\right)p^i\right]F_i^i+ \\ +\beta\left(1-\pi\left(G,G^T,G^N\right)\right)\left(1-p^i\right)F_i^j \end{array}\right\} \tag{15}$$
$$\text{s.t. } 0\leq G\leq\overline{G},$$

where β is the incumbent's discount rate. The first term is the contemporaneous expected utility maximization. The second term represents the expected utility for the next period. The incumbent will be reelected with probability $\pi\left(G,G^T,G^N\right)$, and with probability $\left(1-\pi\left(G,G^T,G^N\right)\right).p^i$ an opponent also identified with the same interests wins the election. In both cases the expenditure level next period is G^{i*}. On the other hand, with probability $\left(1-\pi\left(G,G^T,G^N\right)\right).\left(1-p^i\right)$ the opponent wins the election and represents the other sector interests, in which case expenditures will equal G^{j*}. The probability of this incumbent being reelected, $\pi\left(G,G^T,G^N\right)$, is given by equation 14.

Problem 15 can, then, be rewritten as:[9]

$$\max_{G}\left\{\begin{array}{c} F_i\left(G\right)+\beta.\pi\left(G,G^T,G^N\right)\left(1-p^i\right)\left(F_i^i-F_i^j\right)+ \\ +\beta\left[p^iF_i^i+\left(1-p^i\right)F_i^j\right] \end{array}\right\} \tag{16}$$
$$\text{s.t. } 0\leq G\leq\overline{G},$$

which makes clear that a higher reelection probability increases welfare for the incumbent. Since $\pi(.)$ is increasing in G, it is trivial that any equilibrium strategy for the incumbent must prescribe $G^i\geq G^{i*}$ for the nontradable type.

Proposition 4 *Any equilibrium strategy must prescribe for both types of incumbent a pre-election expenditure level greater or equal to that under full information. Therefore, an equilibrium strategy must prescribe for each type of incumbent a greater or equal level of expenditure before than after elections.*

Corollary 5 *In an equilibrium, when the incumbent is reelected, the real exchange rate is on average more appreciated before than after elections.*

Let $G^i\left(G^T,G^N\right)$ be the set of solutions to problem 16. Given that it is the solution set to the maximization of a continuous function over a compact set, then it is an upper hemi-continuous correspondence.

[9] In case of a mixed strategy equilibrium, the incumbent's problem becomes:

$$\max_{G}\left\{\begin{array}{c} F_i\left(G\right)+\beta.\pi\left(G,H^T,H^N\right)\left(1-p^i\right)\left(F_i^i-F_i^j\right)+ \\ +\beta\left[p^iF_i^i+\left(1-p^i\right)F_i^j\right] \end{array}\right\}$$
$$\text{s.t. } 0\leq G\leq\overline{G}.$$

We represent the solution set for this problem as $G^i\left(H^T,H^N\right)$.

3.2.4 Equilibrium

Proposition 6 Assume beliefs satisfy Assumption A and the trade shocks probability density function satisfies Assumption B. There is a perfect Bayesian equilibrium (possibly with the incumbent strategy prescribing a random action).[10] In any Perfect Bayesian equilibrium, players strategies should satisfy the following conditions: i) an incumbent of type i will choose an action $G^i \in [0, \overline{G}]$ such that $G^i \in G^i(G^T, G^N)$ (where $G^i(.,.)$ is defined in 16) before election, and expenditure level $G^i_{+1} = G^{i*}$ (where G^{i*} is defined in Proposition 1) after the election; ii) the median voter will vote for the incumbent if the observed exchange rate is not greater than $\widetilde{e}(G^T, G^N)$, and $\widetilde{e}(G^T, G^N)$ is defined by:

$$\widetilde{e}(G^T, G^N) = \sup_{w,v}\{e' : f\left(w \mid e(G^N, w) = e'\right) \geq f\left(v \mid e(G^T, v) = e'\right), f(w) > 0\}.$$

In this equilibrium the incumbent is reelected with probability $\pi(G^i, G^T, G^N)$, if he is of the type i (where $\pi(.)$ is given by equation 14).

Proof. See Appendix C. ■

It is obvious that a pooling equilibrium cannot exist. If actions prescribed for the two types were the same, for every exchange rate level compatible with equilibrium, the median voter would attribute probability p^N to the event of a nontradable type incumbent. Then the tradable type incumbent would have an incentive to choose G^{T*}. Similarly, the nontradable type would choose G^{N*}. Since $G^{T*} < G^{N*}$, this cannot be a pooling equilibrium.

Separating equilibrium Let $\overline{e}^i$ and $\overline{e}^i_{+1}$ be the average RER before election and after election, respectively, when the incumbent is of type i, and let $\pi^T = \pi(G^T, G^T, G^N)$ and $\pi^N = \pi(G^N, G^T, G^N)$. The dynamics of the exchange rate is generated by the election of a policymaker of the same type of the incumbent (including reelection) or of a different type. The matrix:

$$P = \begin{pmatrix} \left[\pi^T + \left(1 - \pi^T\right) p^T\right] & \left[\left(1 - \pi^T\right) p^N\right] \\ \left(1 - \pi^N\right) p^T & \pi^N + \left(1 - \pi^N\right) p^N \end{pmatrix} = \begin{pmatrix} P^T \\ P^N \end{pmatrix} \qquad (17)$$

represents the probabilities associated with those transitions. The first row P^T represents the transition probabilities between an incumbent of tradable type before election and a tradable type and a nontradable type of incumbents after election, respectively. Similarly, the second row P^N represents the transition probabilities when the incumbent's type is nontradable.

[10] In the case of a mixed strategy equilibrium, players' strategies should satisfy the following conditions: i) an incumbent of type i will choose a probability distribution $H^i(\cdot)$ on $G^i(H^T, H^N)$ (where $G^i(.,.)$ is defined in footnote 9) before election, and expenditure level $G^i_{+1} = G^{i*}$ (where G^{i*} is defined in Proposition 1) after election; ii) the median voter will vote for the incumbent if the observed exchange rate is not greater than $\widetilde{e}(H^T, H^N)$, defined in footnote 8.

Let ΔE represent the matrix of the changes in conditional average levels of exchange rates after elections:

$$\Delta E = \begin{pmatrix} \overline{e}^T_{+1} - \overline{e}^T & \overline{e}^N_{+1} - \overline{e}^T \\ \overline{e}^T_{+1} - \overline{e}^N & \overline{e}^N_{+1} - \overline{e}^N \end{pmatrix} = \begin{pmatrix} \Delta E^T \\ \Delta E^N \end{pmatrix}. \tag{18}$$

The first row ΔE^T is composed of the changes in average level when the incumbent is tradable and the elected policymaker is tradable and nontradable, respectively. The second row ΔE^T has the equivalent vector for a nontradable incumbent. Notice that all terms are positive, with exception of $\overline{e}^N_{+1} - \overline{e}^T$, which corresponds to the situation where a tradable incumbent is replaced by a nontradable policymaker.

When the incumbent is of the tradable type, the average devaluation, $\Delta\overline{e}^T$, is given by the following inner product:

$$\Delta\overline{e}^T = P^T.\Delta E^{T\prime}.$$

Note that the sign of $\Delta\overline{e}^T$ depends on parameter values, since the second term of ΔE^T is negative.

On the other hand, if the incumbent is of the nontradable type, average devaluation after elections equals:

$$\Delta\overline{e}^N = P^N.\Delta E^{N\prime}.$$

Note that both terms are positive. Therefore, there will be an average exchange rate depreciation when the incumbent being of the nontradable type.

Finally, the unconditional average RER devaluation after elections is given by:

$$\begin{aligned}\Delta\overline{e} &= p^T\Delta\overline{e}^T + p^N\Delta\overline{e}^N \\ &= p^T P^T.\Delta E^T + p^N P^N.\Delta E^N.\end{aligned}$$

The first term can be negative, but the second term is always positive.

4 Example

In this section we work through an example, assuming Cobb-Douglas utility functions for the consumers, and a lognormal distribution for the random shock in the tradable good sector.

4.1 Consumers' problems and equilibrium conditions

Consumers choose how much to consume of each good by maximizing their utility functions, subject to their budget constraints. Using a Cobb-Douglas utility function, each consumer will spend a share α, $\alpha \in (0, 1)$, of her endowment income on tradable good consumption, and a share $(1 - \alpha)$ on nontradable good consumption. A tradable sector citizen net income is given by the value of her random endowment u minus the amount of taxes τ. Tradable sector consumers problem can, then, be represented by:

$$\max_{N_T,T_T} U(N_T,T_T) = \alpha \ln N_T + (1-\alpha)\ln T_T$$
$$\text{s.t. } N_T + eT_T = e.u - \tau.$$

Optimal consumption is:

$$N_T(e,u,\tau) = \alpha(e.u-\tau)$$
$$T_T(e,u,\tau) = (1-\alpha)\frac{(e.u-\tau)}{e},$$

which yields the following indirect utility function:

$$V^T(e,u,\tau) = h + \ln(e.u-\tau) - (1-\alpha)\ln(e), \quad (21)$$

where $h = \alpha \ln \alpha + (1-\alpha)\ln(1-\alpha)$.

The nontradable sector citizen solves a similar problem, except that she does not pay taxes, and her nontradable goods endowment E^N is deterministic. Her problem is represented by:

$$\max_{N_N,T_N} U(N_N,T_N) = \alpha \ln N_N + (1-\alpha)\ln T_N$$
$$\text{s.t. } N_N + eT_N = E^N,$$

The optimal consumption, given by:

$$N_N(e) = \alpha E^N \text{ and}$$
$$T_N(e) = (1-\alpha)\frac{E^N}{e},$$

yields the following indirect utility function:

$$V^N(e) = \overline{h} - (1-\alpha)\ln(e), \quad (22)$$

where $\overline{h} = h + \ln E^N$.

Given the consumers' demand functions, the equilibrium real exchange rate is the one that clears both markets. By substituting the demand functions in one of the market equilibrium conditions represented by equations 3 and 4, and using the fact that $G = \tau$, we arrive at the equilibrium real exchange rate for this economy:

$$e(G,u) = \frac{(1-\alpha)\left(nE^N - G\right)}{\alpha.u}. \quad (23)$$

4.2 Equilibrium under full information

We assume that there is an upper bound $\overline{G}$ for expenditures, such that $\overline{G} < (1-\alpha)\, nE^N$.[11] Also, the tradable endowment u_t has a log-normal distribution, which implies that its probability density function is represented by:

$$f(u) = \frac{\exp\left[-\frac{(\ln u-\mu)^2}{2\sigma^2}\right]}{u\sigma\sqrt{2\pi}}, \tag{24}$$

where μ and σ are parameters.

The policymaker of type i will choose expenditure level G_t in the interval $\left[0, \overline{G}\right]$ so as to maximize her expected indirect utility, which is given by:

$$\begin{aligned} F_i(G_t) &= E\left[V_i^P(G_t, u_t)\right] = \\ &= \gamma_i E\left[V^N(G_t, u_t)\right] + E\left[V^T(G_t, u_t)\right] = \\ &= h^i + \ln\left[(1-\alpha)\, nE^N - G\right] - (1+\gamma_i)(1-\alpha)\ln\left(nE^N - G\right), \end{aligned} \tag{25}$$

for $i = N, T$, where

$$h^i = (\alpha + \gamma_i\alpha - 1)\ln\alpha + \gamma_i \ln E^N + (1+\gamma_i)(1-\alpha)\exp\left(\alpha\mu + \frac{\alpha^2\sigma^2}{2}\right).$$

In case of an interior solution, it will be given by the first order condition:

$$G^{i*} = \left(nE^N\right)\frac{1-(1+\gamma_i)(1-\alpha)^2}{1-(1+\gamma_i)(1-\alpha)}. \tag{26}$$

Notice that in case of an interior solution, G^{i*} is increasing in γ_i, for:

$$\frac{dG^{i*}}{d\gamma_i} = \frac{\alpha(1-\alpha)}{\left[1-(1+\gamma_i)(1-\alpha)\right]^2} > 0. \tag{27}$$

4.3 Equilibrium under Asymmetric Information

For the lognormal distribution of shocks, the exchange rate cutoff point $(\tilde{e})$ will be the exchange rate level for which:

$$f\left(w\left|e\left(G^N, w\right) = \tilde{e}\right.\right) = f\left(v\left|e\left(G^T, v\right) = \tilde{e}\right.\right),$$

where $e\left(G^i, v\right)$ is defined by equation 23. $\tilde{e}$ is defined implicitly by:

$$\left\{\frac{\sigma-\mu}{\sigma} + \frac{1}{2\sigma^2}\left[\begin{array}{c} \ln\left[\left(nE^N - G^N\right)\left(nE^N - G^T\right)\right] + \\ +2\ln\left(\frac{1-\alpha}{\alpha\tilde{e}}\right)\end{array}\right]\right\}\left[\ln\left(\frac{nE^N - G^N}{nE^N - G^T}\right)\right] = 0. \tag{28}$$

[11] This condition assures that tradable citizens have positive net income.

Note that, when $G^N = G^T$, equation 28 is satisfied for any value of $\tilde{e}$. When $G^N \neq G^T$, the exchange rate cutoff level is given by:

$$\tilde{e} = \left(\frac{1-\alpha}{\alpha}\right)\sqrt{(nE^N - G^N)(nE^N - G^T)}\exp\left(1 - \frac{\mu}{\sigma}\right). \tag{29}$$

The cutoff level for the exchange rate depends only on equilibrium strategies, but not on the particular policy G implemented by the incumbent. Given $\tilde{e}$ and the incumbent policy G, it is possible to recover a cutoff level for the trade shock $\widetilde{k}$. It is implicitly defined by $\tilde{e} = e\left(G, \widetilde{k}\right)$, where $e(.)$ is given by 23. Substituting 29 in the left-hand side of 23 yields:

$$k\left(G, G^N, G^T\right) = \frac{\left(nE^N - G\right)\exp\left(\frac{\mu}{\sigma} - 1\right)}{\sqrt{(nE^N - G^N)(nE^N - G^T)}}. \tag{30}$$

The reelection probability is, then, equal to:

$$\pi\left(G, G^N, G^T\right) = \int_{\frac{(nE^N - G)\exp\left(\frac{\mu}{\sigma}-1\right)}{\sqrt{(nE^N-G^N)(nE^N-G^T)}}}^{\infty} \frac{\exp\left[-\frac{(\ln s - \mu)^2}{2\sigma^2}\right]}{s\sigma\sqrt{2\pi}}ds, \tag{31}$$

Policymakers will act strategically in the period preceding elections, as their chosen policy may affect reelection probability. One period before election, each type of policymaker will solve problem 16, given the functional form for the indirect utility function in equation 25, and the reelection probability defined in equation 31. Equilibrium is computed as a fixed point in the best response functions.

We simulate the model economy of our example for two different sets of parameters, presented in Table 1. The simulations differ only with respect to the higher relative weight given by the nontradable type of policymaker for the nontradable sector utility, γ_N, in simulation 1.

Table 1.B presents the results. The first two rows show the expenditure level for each type of incumbent before and after election, respectively. In simulation 1 the nontradable type of incumbent chooses higher expenditures before election in order to signal his type. Thus, when a nontradable incumbent is reelected the exchange rate will depreciate 1%, on average. The tradable type chooses positive expenditures before election, and the minimum level after election. There will also be an exchange rate depreciation (11%) in average when a tradable type of policymaker is reelected.

Table 1: Model Simulation					
A. Parameter Values					
		Simulation 1		Simulation 2	
Share of income spent on tradable good consumption	α	0.3		0.3	
Nontrad. goods endowment (per capita)	E^N	25		25	
#nontrad. voters/#trad. voters	n	2		2	
Density function parameters	μ	4		4	
	σ	1		1	
Mean tradable endowment (per capita)	$E(u)$	90		90	
Probability of nontradable type of policymaker	p^N	0.5		0.5	
Relative weight nontrad. utility	γ_N	4		3	
	γ_T	1		1	
B. Results					
Policymaker's type		N	T	N	T
		Simulation 1		Simulation 2	
Optimal pre-electoral exp.	G^i	29.2	4.4	26.7	5.5
Optimal post-electoral exp.	G^i_{+1}	29	0	17.3	0
Reelection probability	π^i	92%	73%	91%	74%
Average pre-electoral RER	$\overline{e}^i$	1.03	2.26	1.14	2.36
Average post-electoral RER	$\overline{e}^i_{+1}$	1.04	2.48	1.16	2.48
Average depreciation	$\Delta\overline{e}^i$	6.8%	1%	6.1%	-2.4%
Average ex-ante depreciation	$\Delta\overline{e}$	3.9%		1.8%	

The nontradable type of incumbent has a higher probability of being reelected than the tradable one (92% against 73%). There is an exchange rate depreciation when the nontradable type of incumbent is succeeded by a nontradable, and an even stronger average depreciation when he is succeeded by a tradable type of policymaker. As a result, there is an expected 6.8% exchange rate depreciation when the incumbent is of nontradable type. When the incumbent is of tradable type, there is a RER depreciation when he is succeeded by a policymaker of his own type, but there is a RER appreciation when his successor is of the nontradable type. There is still an 1% expected RER depreciation when the incumbent is of tradable type. Unconditional average depreciation of 3.9% after election is then generated.

Simulation 2 results are similar, except that a 2.4% average exchange rate appreciation is generated when the incumbent is of tradable type. Nevertheless, there is a 1.8% unconditional average exchange rate depreciation[12].

[12] For some parameter values the model generates average appreciations after elections. The driving force is the substantial appreciation that may occur when a tradable type of incumbent is defeated by a nontradable opponent. In those cases, this effect outweighs the devaluation that occurs in the three other possible configurations: tradable incumbent reelected and nontradable incumbent followed by either type.

5 Concluding Remarks

In this paper we developed a theoretical model based on the distributive conflict over macroeconomic policy which generates a political economic cycle. The model is focused on the exchange rate, whose management is the object of conflict between the tradable and nontradable sectors. However, our approach can be generalized to other conflicts that either have no or little effect on aggregate economic activity. A good example is the struggle over the allocation of budget appropriations among social groups. While one group, say industrialists, count on its ability to pressure government officials at smoke-filled rooms, other groups, such as consumers, command an electoral majority. This type of approach for political cycles has been advocated by Drazen (2000).

Another innovative feature of our approach is that economic policy is not observed by voters, given that macroeconomic performance results from both policy and exogenous shocks. This way of modelling the influence of policy on elections results has a further realistic implication: exogenous shocks also affects election through their effect on macroeconomic performance.

In addition, our model assumes that policymakers' preferences over economic policy change over time. Such an assumption goes against the grain of extant models of partisan policy cycles, which are based on fixed preferences. We believe that our modelling is a superior representation of the political reality particularly of countries where political parties are programmatically weak, catch all organizations, or where the government bureaucracy can unilaterally set economic policy and at the same time is easily captured by powerful interest groups through either lobbying or bribery. Most Latin American countries satisfy one of these political conditions. In this way, one of the gains afforded by our model lies in its ability to unveil the analytical mechanisms underlying the exchange rate electoral cycles observed in this region.

References

[1] Alesina, A. (1987), "Macroeconomic Policy in a Two-Party System as a Repeated Game," Quarterly Journal of Economics 102: 651-78.

[2] Alesina, A. and H. Rosenthal (1995), Partisan Politics, Divided Government, and the Economy, Cambridge University Press.

[3] Alfaro, L. (1999), "Why Governments Implement Temporary Stabilization Programs," Journal of Applied Economics II(2): 211-45.

[4] Ames, B. (1987), Political Survival, Berkeley, CA: University of California Press.

[5] Block, S. (2000), "Political Business Cycle, Democratization, and Economic Reform: the Case of Africa," working paper, Fletcher School, Tufts University.

[6] Bonomo, M. and C. Terra (1999), "The Political Economy of Exchange Rate Policy in Brazil: an Empirical Assessment," *Revista Brasileira de Economia* 53: 411-432.

[7] Cukierman, A. and A. Meltzer (1986), "A Positive Theory of Discretionary Policy, the Costs of Democratic Government, and the Benefits of a Constitution," *Economic Inquiry* 24: 367-88.

[8] Drazen, A. (2001), "The Political Business Cycle after 25 Years," *NBER Macroeconomics Annual 2000*, MIT Press.

[9] Frieden, J., P. Ghezzi and E. Stein (2001), "Politics and Exchange Rates: A Cross Country Study," in J. Frieden and E. Stein, *The Currency Game: Exchange Rate Politics in Latin America*, IDB, Washington.

[10] Ghezzi, P., E. Stein and J. Streb (2000), "Real Exchange Rate Cycles around Elections," mimeo IDB.

[11] Gonzalez, Maria de los A. (2000), "On Elections, Democracy and Macroeconomic Policy Cycles: Evidence from Mexico," mimeo, Princeton University.

[12] Hibbs, D. (1977), "Political Parties and Macroeconomic Policy," *American Political Science Review* 71: 146-87.

[13] Kraemer, Moritiz. (1997), "Electoral Budget Cycles in Latin America and the Caribbean: Incidence, Causes, and Political Futility," Working Paper Series #354. Office of the Chief Economist, Inter-American Development Bank.

[14] Lewis-Beck, M. (1988), *Economics and Elections: The Major Western Democracies*, University of Michigan Press.

[15] Lindbeck, A. (1976), "Stabilization Policies in Open Economies with Endogenous Politicians," *American Economic Review Papers and Proceedings*: 1-19.

[16] Nordhaus, W. (1975), "The Political Business Cycle," *Review of Economic Studies* 42: 169-90.

[17] Rogoff, K. (1990), "Equilibrium Political Budget Cycles," *American Economic Review* 80: 21-36.

[18] Rogoff, K. and A. Silbert (1988), "Elections and Macroeconomic Policy Cycles," *Review of Economic Studies* 55: 1-16.

[19] Schuknecht, L. (1996), "Political Business Cycles in Developing Countries," *Kyklos* 49: 155-70.

[20] Stein, E. and J. Streb (1998a), "Political Stabilization Cycles in High Inflation," *Journal of Development Economics*.

Appendix

A Equilibrium under full information

Proposition 7 *In the complete information version of the game there is only a subgame perfect equilibrium. In this equilibrium, players will choose the following strategies: i) a tradable type of incumbent will choose expenditure level G^{*N}, both before and after election, where G^{N*} is the expenditure level in the set $\left[0, \overline{G}\right]$ that maximizes V_N^P; ii) a nontradable type incumbent will choose expenditure level G^{T*}, both before and after election, where G^{T*} is the expenditure level in the set $\left[0, \overline{G}\right]$ that maximizes V_T^P; iii) $G^{N*} \geq G^{T*}$; iv) the representative voter will vote for the incumbent if she is of the nontradable type, or if the opponent is of the tradable type, and for the opponent, otherwise.*

Proof. The complete information case may be solved by backward induction. At the period after election the policymaker actions will not affect her future utility, and she will choose the expenditure level that maximizes the expected value of her current indirect utility function, represented by equation 6. Let G^{N*} and G^{T*} be the argument that maximizes $E\left[V_i^P(G,u)\right]$, for $i = N, T$, that is, for the policymaker that favors nontradable and tradable sectors, respectively. Given the concavity of V_i^P in G, $G^{N*} \geq G^{T*}$.

When voting, citizens know this, and the median voter strictly prefers electing a nontradable policymaker. If the incumbent is nontradable and the opponent is tradable, she votes for the incumbent, if the reverse is true she votes for the opponent, and if both the incumbent and the opponent are of the same type, the median voter is indifferent between them. To untie, we suppose the incumbent is reelected.

At the period before elections, the policymaker know her reelection is independent of her pre-election choice of expenditures. The tradable type policymaker chooses expenditures so as to maximize:

$$E\left[V_T^P(G_t,u_t) + \beta\left[pV_T^P\left(G^{N*},u_t\right) + (1-p)V_T^P\left(G^{T*},u_t\right)\right]\right],$$

where β is the intertemporal discount rate. It is clear that maximizing the expected intertemporal utility function is equivalent to maximizing expected pre-election utility. She will choose minimum expenditures level G^{T*}.

Similarly, the nontradable policymaker chooses expenditures so as to maximize:

$$E\left[V_N^P(G_t,u_t) + \beta V_N^P\left(G^{N*},u_t\right)\right].$$

Note that this type of policymaker is always reelected. Here, again, optimal policy will be the one that maximizes current utility, which is maximum expenditures level G^{N*}. ■

B Proof to Proposition 3

Under Assumption A, the incumbent's reelection probability is given by equation 13. We will prove that the reelection probability defined in equation 13 is equivalent to equation 14, when Assumption B is satisfied. Equation 13 may be rewritten as:

$$\pi(G, G^T, G^N) = \tag{32}$$
$$\Pr\left(\begin{array}{c} \{u : f\left(w \left| e\left(G^N, w\right) = e\left(G, u\right)\right.\right) \geq f\left(v \left| e\left(G^T, v\right) = e\left(G, u\right)\right.\right)\} \\ \text{and } f\left(w \left| e\left(G^N, w\right) = e\left(G, u\right)\right.\right) > 0 \end{array} \right) +$$
$$\Pr\left(\left\{u : e(G, u) \leq \inf_{\{w: f(w) > 0\}} \left\{e\left(G^N, w\right)\right\}\right\}\right).$$

Define the functions $w\left(u\right)$ and $v\left(u\right)$ as the shocks w and v that satisfy $e\left(G^N, w\right) = e\left(G, u\right)$ and $e\left(G^T, v\right) = e\left(G, u\right)$, respectively, for a given shock u, equilibrium strategies G^N and G^T, and a given expenditure level G. Given that $G^N > G^T$, and since real exchange rate is strictly decreasing in the tradable sector supply shock, it is always true that $w\left(u\right) < v\left(u\right)$.

Let us define $\underline{w}$ and $\overline{w}$ as:

$$\underline{w} = \inf\left\{u : f(w(u)) > 0\right\} \text{ and } \overline{w} = \sup\left\{u : f(w(u)) > 0\right\}.$$

When $u > \overline{w}$, then $w\left(u\right) > w\left(\overline{w}\right)$. This corresponds to the second term in equation 32, and the incumbent is reelected. The probability of reelection due to the second term can be written as:

$$\int_{\overline{w}}^{\infty} f(u)du.$$

When $u < \underline{w}$, then $w\left(u\right) < w\left(\underline{w}\right)$. Neither terms in equation 32 is satisfied: $f\left(w\left(u\right)\right) = 0$, hence the first term is not satisfied, and $e(G, u) \geq \inf_{\{w: f(w) > 0\}}\left\{e\left(G^N, w\right)\right\}$, hence the second term is not satisfied, and the incumbent is not reelected.

Let us now analyze the case when $\underline{w} \leq u \leq \overline{w}$, which yields $w\left(\underline{w}\right) \leq w\left(u\right) \leq w\left(\overline{w}\right)$. In this region $f\left(w\left(u\right)\right) > 0$, so that these are all candidates for satisfying the first term in equation 32

The single peak property of density function means that there is a nonempty set X with elements x that satisfy, for any u:

$$\text{if } w\left(u\right) < v\left(u\right) \leq x \text{ then } f\left(w\left(u\right)\right) \leq f\left(v\left(u\right)\right) \text{ and} \tag{33}$$
$$\text{if } x \leq w\left(u\right) < v\left(u\right) \text{ then } f\left(w\left(u\right)\right) \geq f\left(v\left(u\right)\right). \tag{34}$$

The single peak plateau property assures that all points with the same nonzero density values (plateaus) belong to X. Let $\underline{x} = \inf X$.

For all trade shock realizations that yield $\underline{x} \leq w\left(u\right) \leq w\left(\overline{w}\right)$ condition 34 is satisfied, hence the first term in equation 32 is satisfied and the incumbent will be reelected. Let $\overline{u} = w^{-1}\left(\underline{x}\right)$. The incumbent is reelected whenever $\overline{u} \leq u \leq \overline{w}$.

For trade shocks that yield $w\left(\overline{w}\right) \leq w\left(u\right) < v\left(u\right) \leq \underline{x}$ condition 33 is satisfied. As $f\left(v\left(u\right)\right) > 0$, and given the single peak plateau property, we have that $f\left(w\left(u\right)\right) < f\left(v\left(u\right)\right)$. In this case the incumbent is not reelected. Let $\underline{u} = v^{-1}\left(\underline{x}\right)$. The incumbent is not reelected whenever $\underline{w} \leq u \leq \underline{u}$.

Finally, we have to investigate the case when $w(\overline{w}) \leq w(u) < \underline{x} < v(u)$, that is, when $\underline{u} < u < \overline{u}$. We know that $f(w(\underline{u})) - f(v(\underline{u})) < 0$, because condition 33 is satisfied, and the single peak plateau property precludes equality in this region. We also know that $f(w(\overline{u})) - f(v(\overline{u})) \geq 0$. Furthermore, $f(w(u)) - f(v(u))$ is increasing in u when $\underline{u} < u < \overline{u}$ for the following reason. $f(w(u))$ is increasing in $w(u)$ because $w(u) < \underline{x}$, and $f(v(u))$ is non-increasing in $v(u)$ because $v(u) \geq \underline{x}$. Hence, there will be a point $k \in [\underline{u}, \overline{u}]$ such that for $u < k$, $f(w(u)) - f(v(u)) < 0$ and, for $u \geq k$, $f(w(u)) - f(v(u)) \geq 0$. Then, the incumbent is reelected for $k \leq u \leq \overline{u}$. Since she is also reelected for $\overline{u} \leq u \leq \overline{w}$, it is reelected for $k \leq u \leq \overline{w}$. This interval corresponds to the first term in 32. The probability due to the first term can be written as:

$$\int_k^{\overline{w}} f(u)\, du.$$

Summing the first and the second term in 32, the probability of reelection can be represented as:

$$\int_k^{\infty} f(u)\, du.$$

It remains to show that k is as defined in Proposition 3. First, notice that according to our definition of k in this proof we have:

$$k\left(G, G^N, G^T\right) = \\ \inf \left\{ \begin{array}{c} u : f\left(w \left| e\left(G^N, w\right) = e(G, u)\right.\right) \geq f\left(v \left| e\left(G^T, v\right) = e(G, u)\right.\right) \\ \text{and } f(w(u)) > 0 \end{array} \right\}.$$

Now define $\widetilde{e}\left(G^N, G^T\right) \equiv e(G, k)$. Then,

$$\widetilde{e}\left(G^N, G^T\right) = \sup \left\{ \begin{array}{c} \hat{e} : f\left(w \left| e\left(G^N, w\right) = \hat{e}\right.\right) \geq f\left(v \left| e\left(G^T, v\right) = \hat{e}\right.\right), \\ f\left(w \left| e\left(G^N, w\right)\right.\right) > 0 \end{array} \right\}.$$

Thus k is as defined in Proposition 3.

C Proof to Proposition 4

Application of the Kakutani's fixed point theorem to the vector $G^* = \begin{pmatrix} GN(G^T, G^N) \\ GT(G^T, G^N) \end{pmatrix}$: upper hemi-continuous correspondence on a compact set gives the desired result.